IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA,	)	
	)	
Plaintiff,	)	
	)	
v.	)	**Case No. 05-cv-329-GKF(PJC)**
	)	
TYSON FOODS, INC., et al.,	)	
	)	
Defendants.	)	

DECLARATION OF JIM C. LOFTIS, Ph.D., P.E.

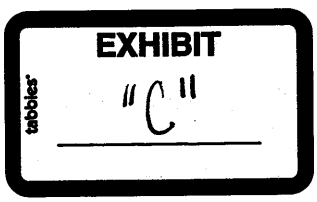
I, Jim C. Loftis, Ph.D., P.E. hereby declare as follows:

I. BACKGROUND

1. Since January of 1979, I have been a faculty employee of Colorado State University and am currently serving as professor in the Department of Civil and Environmental Engineering. My educational background includes a Bachelor of Science degree in Agricultural Engineering from Oklahoma State University and Master of Science and Doctor of Philosophy degrees in Agricultural Engineering from Colorado State University in 1976 and 1978, respectively. I am a registered Professional Engineer in the State of Colorado.

2. I have taught at least 20 different courses at Colorado State University, focusing on water and the environment in courses such as Environmental Statistics and Nonpoint Pollution. To serve the professional community, I have taught short courses in Water Quality Monitoring Network Design and Environmental Statistics in the United States, New Zealand, and Australia.

3. My faculty appointment as Colorado State University has involved a significant outreach and public education component through Cooperative Extension, and in 1990



my Extension activities in the area of agricultural impacts on water quality were recognized through an Outstanding Achievement Award from U.S. EPA Region VIII.

4. My research activities have focused in the area of environmental statistics, design of water quality monitoring networks, and agricultural nonpoint source pollution. I have also conducted significant research in the areas of water resource system optimization and irrigation management. My research sponsors have included the National Park Service, US Environmental Protection Agency, the US Department of Agriculture, the US Geological Survey, the US National Science Foundation, and IBM Corporation. My recent research and consulting activities have included the following: serving as one of three experts on an external review panel for "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance", 2004 Draft, U.S. Environmental Protection Agency; the design of water quality monitoring networks for the Big Thompson Watershed and the Upper Cache La Poudre River for northern Colorado water providers; statistical evaluation of reservoir and stream quality monitoring data for Colorado Front Range water providers; development of modeling and monitoring approaches for managing selenium contamination in the Gunnison River Basin; and evaluation of salinity sources and trends in the lower South Platte River basin.

5. In September of 2007 I was retained by counsel for the State of Oklahoma to provide environmental statistical expertise and assistance with their analysis of water quality monitoring data for the Illinois River Watershed and analysis of sources of contamination . My greatest involvement in the case has been in providing peer review for Dr. Roger Olsen in his principal components analysis (PCA) of the IRW data, and

closely related areas of work, including the development of conclusions from the PCA in light of other evidence in the case as well as statistical review of some expert reports.

II. BASIS FOR OPINIONS

6. I have reviewed the opinions of Dr. Charles Cowan contained in his expert report "Rebuttal Report, Review of Principal Components Analysis of Data And Review of Inferences about Presence of Biomarkers in the Population of Animals from the Illinois River Watershed", November 26, 2008 and his deposition (Deposition of Charles Cowan, PhD, February 17-18, 2009). I have reviewed the opinions of Dr. Brian Murphy contained in his expert report "Expert Report of Brian L. Murphy, PhD", January 23, 2009 and his deposition (Deposition of Brian Murphy, PhD, March 25-26, 2009). I have reviewed the opinions of Dr. Glenn Johnson contained in his expert report "Rebuttal Report, Principal Components Analysis of Geochemical Data from the Illinois River Watershed Northwest Arkansas and Eastern Oklahoma", November 21, 2008 and his deposition (Deposition of Glenn Johnson, PhD, February 24-25, 2009).

III. OPINIONS OF COWAN

7. In my opinion, Dr. Cowan is not qualified to provide an expert opinion on Dr. Olsen's application of principal components analysis to the Illinois River Watershed due to his lack of experience in the area of the science of water quality and environmental statistics. At Colorado State University we offer a separate graduate course in environmental statistics. This course was introduced by me and a colleague in the Department of Statistics because we believe that environmental statistics deserve special evaluation and importance and the unique issues concerning environmental statistics were

insufficiently covered in traditional statistics courses. Those areas included handling of laboratory non-detects and application of the log-normal distribution to environmental data sets. Both of these areas feature prominently in Dr. Cowan's report, and it is clear that he has little experience with them. His report and his deposition testimony demonstrate that he is unaware of the common methods of dealing with laboratory non-detects and of the importance and wide application of the log-normal distribution in environmental data. Although Dr. Cowan does understand the mathematics of principal components analysis, he incorrectly believes that principal components developed on logarithms of data can somehow be back transformed into quantities with physically meaningful values and units. This belief demonstrates a serious lack of understanding of what Dr. Olsen did. Dr. Cowan is also apparently unaware of the common practice of averaging of duplicate environmental analyses prior to statistical analysis. A number of Dr. Cowan's major criticisms of Dr. Olsen's principal components analysis are therefore inadequately supported by Dr. Cowan's areas of experience and expertise.

IV. MURPHY'S MULTIMEDIA PCA ANALYSIS AND OPINION

8. Dr. Murphy states that: "Dr. Olsen's PCA is not a true "pathway" analysis, because he does not combine solid and liquid samples in the same analysis. A multimedia analysis indicates that Cargill contract growers, including the sole Cargill contract grower with onsite environmental data, are not contributing determinable downstream concentrations." (Murphy Report, page 10 and Section 5). Dr. Murphy spent a large amount of his expert report criticizing Dr. Olsen for not doing a multimedia PCA.

9. In my opinion, a multimedia analysis for this type of system is clearly not appropriate and is not supported by the published literature. The multimedia analysis is not appropriate for the IRW study because PCA takes advantage of relationships or correlations among variables, and these relationships will be much different in the solid phase than in the liquid phase. Therefore the chemical signature or fingerprint that PCA is designed to capture will not be preserved from the solid medium to the liquid medium. This is a particular problem in the IRW study because this study includes several different types of water quality variables with widely varying transport properties. The variables include nutrients, basic ions, metals, and bacteria. Some of these variables (such as phosphate and metals) are typically strongly adsorbed to soil and organic matter, and move in both the dissolved and solid phases, while others, such as nitrate, are not adsorbed and move largely in the dissolved phase.

10. Dr. Olsen's approach, which considers only one phase (solids or liquids) at a time, is far more appropriate for the IRW system. Olsen's PCA on liquid samples includes the entire fate and transport pathway from the edge of field samples, (which consist largely of runoff from the field and would directly reflect whatever poultry litter impacts occur) to the streams and rivers of the IRW and eventually to Lake Tenkiller. This is a much more logical and coherent approach and one that has been demonstrated in the technical literature for distributed water quality impacts from naturally occurring constituents such as phosporus.

11. Dr. Murphy's deposition indicates that he realizes that multimedia PCA is not appropriate since a contaminant fingerprint will not be preserved from medium to medium. In his deposition Dr. Murphy discussed a previous case involving a PCA

analysis and determined that the fingerprint isn't preserved from one media to another so multimedia PCA was inappropriate. Murphy Deposition 49:19 – 50:12. This is the same reasoning that I presented above in stating that multi-media PCA is not appropriate in the IRW study.

12. The multimedia approach suggested by Murphy for PCA analysis demonstrates an overall serious problem with Dr. Murphy's opinions - they are based on a review and consideration of Dr. Olsen's PCA results in isolation from the rest of the case and separated from the phosphorus mass balance, chemical transport modeling, and other important analyses that have been performed by the State of Oklahoma scientists. It also demonstrates why his multimedia PCA analysis is flawed. In Dr. Murphy's deposition, he states that he does not use PCA on its own but rather to "… see what's going on in a site…" (Murphy Deposition at 11:5-18). Along with most, if not all scientists working in pollution cases, Dr. Murphy uses a mass balance, accompanied by pollutant transport modeling, as the primary basis for most of his analyses in other cases (Murphy Deposition at 10:4-19, 12:16-21, 15:8 - 16:19, 17:7-19, 26:21 -. 27:20, and 57:5-12).

13. This is the same overall approach that underlies Dr. Olsen's overall opinions as to sources of phosphorus in the IRW and his PCA analysis of a poultry source signature. The mass balance provides the underlying foundation; pollutant transport modeling provides more detail; and PCA provides an overall, multivariate description of water quality variability and patterns from a purely statistical perspective. Since the mass balance is the most fundamental and physically (as opposed to statistically) based approach, it would typically carry the greatest weight of evidence for an investigation of

sources of contamination. However, in this one case of the IRW, Dr. Murphy does not give even the slightest consideration to the mass balance or pollutant transport modeling, both of which have been extensively developed by other experts, in forming his opinions of Dr. Olsen's conclusions. (Murphy Deposition at 175:18 -. 176:10, 216:22 - 218:1, 221:8 – 222:9).

V. MURPHY'S OPINION ON CARGILL CONTRIBUTION TO STREAM CONTAMINATION

14. Murphy's expert report (p.22) includes the following:

> The samples used in my analysis are shown in Table 3-3 below. The purpose of identifying locations downstream and downgradient of Cargill contract growers is to see if there is any evidence that samples from these locations differ significantly from reference (background) samples.
>
> **Table 3-3. Sample locations downstream or downgradient of Cargill contract growers**

15. From Dr. Murphy's deposition testimony, it is apparent that he did not actually do any analysis to see whether or how much poultry litter was applied upstream of these locations. (Murphy Deposition 198: 4 -.200:7, 206:14-21, 207:1-23, and 299:21 – 300:13) This analysis is essential for an investigator's evaluation of whether waste from a poultry growing operation has impacted a river or stream. Clearly, one must sample locations downgradient (downstream) of fields where there has been land disposal, but Dr. Murphy did not consider this in his analysis.

16. In summary, Dr. Murphy did not consider whether or not poultry waste had actually been applied upstream of his sample locations. This is a fatal omission in the basis for his opinion that Cargill operations did not contaminate IRW rivers and streams.

VI. JOHNSON'S OPINION ON TOTAL CONCENTRATION AND GEOCHEMICAL PARTITIONING

17. Dr. Johnson's sixth major opinion from his rebuttal report, page 5, reads as follows.

> • **Failure to Recognize Influence of Total Concentration and Geochemical Partitioning on the PCA.** By assuming from the outset that source signatures control this data set, Olsen completely missed the two primary controls on the surface water and groundwater data sets: (1) total concentration; and (2) how chemicals redistribute in the environment according to their affinity for the dissolved phase versus association with suspended particulate matter. Olsen's PCA cannot be used to infer any source of contamination to the IRW, let alone poultry.

18. It is clear from Dr. Johnson's background and from his deposition that he is not qualified to assess whether or not Dr. Olsen adequately considered chemical distribution among phases and/or transport processes that are active in the IRW. Dr. Johnson has essentially no background in agricultural chemical transport or nonpoint source pollution from agriculture. His experience is largely confined to hazardous waste, especially PCBs and other synthetic hazardous substances. These chemicals move and distribute in the environment much differently from phosphorus.

19. Dr. Johnson is apparently unaware of the importance or otherwise chose not to consider the concentrations of the chemicals of concern in the IRW since his analysis focuses on ratios, rather than considering concentrations directly, as Dr. Olsen has done.

20. Dr. Johnson is not aware of the concentration of phosphorus that would be of concern (action level) in the IRW (Johnson Deposition 469:23-470: 1). Therefore, he

does not know whether the currently observed concentrations in the IRW represent naturally occurring conditions or instead represent elevated levels due to sources related to human activity such as the land application of poultry waste. He therefore has no reliable scientific basis for his conclusion that phosphorus patterns in the IRW are related to processes and not sources. Furthermore, Dr. Johnson's background in phosphorus chemistry, adsorption, and transport is limited (Johnson Deposition 446: 20 – 452:1). He does not have a strong background or understanding of the processes that he claims are controlling water quality patterns in the IRW.

I declare under penalty of perjury, under the laws of the United States of America, that the foregoing is true and correct.

Executed on the 18th day of May, 2009.

Jim C. Loftis